

New or Revised Provisions EPA is Disapproving

APPENDIX E. REQUIREMENTS FOR DEVELOPMENT OF SITE-SPECIFIC CRITERIA FOR CERTAIN PARAMETERS

City of Poteau site-specific metals criteria

Oklahoma submitted site-specific criteria for cadmium, silver and lead for the Poteau River in eastern Oklahoma, which receives a discharge from the City of Poteau wastewater treatment plant. EPA found problems with the methodology used to develop the criteria as well as mathematical errors in the calculations, resulting in criteria that may not be protective of aquatic life at this site. The criteria development process and EPA's concerns are described below.

Due to the water quality characteristics of the discharge and receiving water body, a water effect ratio (WER) study was performed to determine if site-specific water quality criteria for cadmium, silver and lead would be more appropriate than the statewide aquatic life criteria. The purpose of using the WER procedure is to account for any difference that exists between the toxicity of a pollutant in laboratory dilution water and its toxicity in site water. EPA's concerns include the analysis of the toxicity data presented in the study and miscalculations of final criteria.

In the Poteau study, the discharger's effluent was used to represent the simulated downstream water. The effluent had higher hardness concentrations than the laboratory water and receiving stream. Since the WER is designed to account for toxicity differences in the comparison waters, it is important that the data be analyzed with the same hardness concentrations. Metal toxicity tests at higher hardness concentrations will generally be less toxic to test species than tests conducted at lower hardness concentrations. The difference in hardness between the Poteau effluent and laboratory water produced an artificially high WER. Thus, the WER that was applied to the statewide criteria produced an under protective site-specific criteria. To correct for the hardness differences between the laboratory water and simulated downstream water, a normalization equation should be used to adjust the calculated laboratory and simulated downstream toxic effects (LC_{50s}) to a common hardness value. Using a common hardness eliminates the artificial increase in pollutant concentrations at which toxic effects are observed. The normalization calculation allows for accurate comparison of toxic effects between the site and laboratory water. The normalization procedure to account for the mitigating effects of hardness was not used in this study and therefore the site-specific criteria may not be protective.

Normalization is described in EPA's 1994 *Interim Guidance on Determination and Use of Water-Effect Ratios for Metals*, as well as EPA's 2002 *Streamlined Water-Effect Ratio Procedure for Discharges of Copper*. The normalization equation is included below. The acute metal slope would need to be adjusted for each metal evaluated.

$$EC50_{\text{at std hardness}} = EC50_{\text{at sample hdnes}} * (\text{Std Hdns}/\text{Sample Hdns})^{\text{acute metal slope}}$$

EPA calculated the lead criteria to demonstrate the difference in the final criteria values using the normalization procedures and study data. The normalization equation was used to adjust the effluent LC₅₀ concentrations to the laboratory hardness concentrations.

Lead	Acute µg/l	Chronic µg/l
OK proposed total criteria	81.5	3.2
EPA calculated total criteria	23.9	0.94

In addition to hardness normalization process for the laboratory and site water, the laboratory water LC₅₀ concentrations should be compared to the species mean acute value (SMAV) found in each metals criteria document. If the hardness-normalized LC₅₀ in laboratory water is less than the documented SMAV, then the SMAV should be used in the WER calculations, per EPA's *Streamlined Water-Effect Ratio Procedure for Discharges of Copper* guidance document. EPA recommends reviewing the laboratory toxicity data to determine if the data is being used appropriately in the WER calculations.

The proposed silver and lead criteria calculations also contained mathematical errors. Statewide dissolved criteria were calculated from the statewide total criteria. EPA recommends that these calculations be reviewed to verify and correct any miscalculations.

Given that the toxic effects of cadmium, lead and silver were not normalized for hardness and based on the calculation errors in the site-specific metals criteria, these criteria may be under-protective. Sound scientific rationale demonstrating these criteria protect aquatic life has not been provided and the criteria are not consistent with 40 CFR §131.11(a). Therefore, EPA is disapproving the site-specific criteria. Under 40 CFR §131.21(c), new and revised standards do not go into effect for Clean Water Act (CWA) purposes until approved by EPA. Therefore, the criteria developed for City of Poteau cannot be used in a permit or other regulatory program. The currently approved statewide aquatic life criteria for cadmium, silver and lead will remain in effect. Because the statewide aquatic life criteria for cadmium, silver and lead will remain in effect, there is no need for EPA to propose and promulgate replacement criteria in light of its disapproval of the site-specific criteria.

OAC 785:45-5-13(h) Criteria to protect Livestock Agriculture subcategory

Livestock Agriculture Subcategory

The State has adopted new subcategories for the agriculture designated use. The subcategories are irrigation agriculture and livestock agriculture. The adoption of the subcategories was approved by EPA on October 22, 2008 and is now effective under the CWA. However, EPA did not take action on the new total dissolved solids (TDS) criterion. The new TDS criterion sets a *minimum* concentration of 2500 mg/l to protect

the livestock agriculture designated use. In addition, the livestock subcategory contains no chloride or sulfate criteria. The proposed revision is below.

(h) Criteria to protect Livestock Agriculture subcategory. For the purpose of protecting the Livestock Agriculture subcategory, neither long term average concentrations nor short term average concentrations of minerals shall be required to be less than 2500 mg/L for TDS.

EPA found several problems with the criteria and provision. The provision sets the minimum TDS criterion that would be applied to protect the livestock use subcategory. The approach of setting minimum criteria is not consistent with how criteria are typically developed and implemented in water quality standards. Criteria are generally maximum concentrations that have been determined to be protective of a designated use. In this case, a maximum concentration is unknown. It is unclear how the State will determine a maximum concentration that would be implemented to protect the livestock subcategory. Based on the provision, the State appears to conclude that any TDS criterion above 2500 mg/l is protective of the livestock use and no controls are necessary below 2500 mg/l. Thus, effectively no TDS criteria apply to protect the livestock agriculture use.

Further, the livestock subcategory contains no chloride or sulfate criteria. The site-specific study for Nine Mile Creek, which developed minerals criteria based on the agriculture use, described livestock limitations for TDS, as well as chloride and sulfate. It is unclear why Oklahoma determined that chloride and sulfate criteria are not appropriate for a livestock use when data have been provided describing livestock requirements for both. Therefore, the absence of an upper limit for TDS criteria and the absence of chloride and sulfate criteria may not be protective of the livestock use.

The State has not demonstrated that the new livestock criterion protects the livestock agriculture use. Therefore, EPA is disapproving the criterion for the livestock subcategory provision. Since no water bodies have been designated with this use, no change in water body criteria has occurred. All water bodies are by default designated with the irrigation subcategory. Therefore, existing minerals criteria described in Appendix F of the water quality standards would continue to apply to Oklahoma waters. Under 40 CFR §131.21(c), new and revised standards do not go into effect for CWA purposes until approved by EPA. Therefore, the criterion developed for the livestock subcategory can not be used in a permit or other regulatory program. The currently approved irrigation agriculture criteria for TDS, chloride and sulfate will remain in effect. Because the irrigation agriculture criteria for TDS, chloride and sulfate will remain in effect, there is no need for EPA to propose and promulgate replacement criteria in light of its disapproval of the livestock subcategory criterion.

Please note that while this provision was developed to protect the livestock agriculture use, more sensitive designated uses would likely be impaired by an unknown maximum TDS criterion and removal of chloride and sulfate criteria. The standards regulations at 40 CFR §131.11(a) state "For waters with multiple use designations, the criteria shall

support the most sensitive use.” Therefore, for waters where more sensitive uses occur, such as aquatic life, TDS, chloride and sulfate criteria protective of that such uses must apply.

New or Revised Provisions for Which EPA is Not Taking Action

APPENDIX E. REQUIREMENTS FOR DEVELOPMENT OF SITE-SPECIFIC CRITERIA FOR CERTAIN PARAMETERS

Nine Mile Creek Site-Specific Minerals Criteria

The State proposed new TDS, chloride and sulfate criteria for the unnamed tributary to Nine Mile Creek and Nine Mile Creek. The streams are located in Comanche County, Oklahoma, and receive effluent from the Public Service Company of Oklahoma Comanche Generating Station. The discharger is a power plant that re-uses the City of Lawton treated waste water, which is piped into the facility’s cooling lake. This is the second set of site-specific criteria developed for these streams. The current CWA effective site-specific criteria were developed in 1998. The designated uses applicable to the streams are agriculture, warm water aquatic community, aesthetics, and primary body contact recreation.

The following table describes the existing and proposed criteria.

	Yearly Mean mg/l	Single Sample mg/l
Current criteria - unnamed tributary		
TDS	809	879
Chloride	231	262
Sulfate	128	145
Current criteria - Nine Mile Creek		
TDS	830	950
Chloride	232	279
Sulfate	124	150
Proposed criteria for both		
TDS	2500	2999
Chloride	1600	2000
Sulfate	400	500

The development study focused on determining criteria appropriate for the agriculture use. Based on the study and data presented, the State intended to show that aquatic life would not be impacted under the proposed levels of TDS, chloride and sulfate appropriate for agriculture. However, EPA does not agree that the State accomplished this task. It is not clear, based on chemical and biological sampling on the streams, that the proposed criteria protect the aquatic life use. EPA’s has concerns with several aspects of the study.

The study included a comparison of reference site TDS concentrations to Nine Mile

Creek and its tributary. The comparison was intended to demonstrate that minimal impact would occur to fish and invertebrates at the proposed levels of TDS, chloride and sulfate. However, the sites provided difficult or inappropriate comparisons to the conditions in Nine Mile Creek. The comparison streams were characterized in the study as Oklahoma Conservation Commission-selected candidate reference streams but EPA could not identify most of these streams in the Commission's final recommendations for candidate reference streams. Other problems in the comparison streams included many listings on the State's impaired waters report for mineral and fish bioassessment impairments and only a couple of the comparison streams appeared in the same ecoregion as Nine Mile Creek. While Nine Mile Creek and the tributary are effluent-dominated streams, the reference stream approach was used to evaluate if other streams with minimal anthropogenic effects have similar aquatic life communities at the proposed Nine Mile Creek criteria.

The comparison stream data focused on the proposed TDS criterion and did not include data at the proposed sulfate and chloride concentrations related to aquatic life. The study also concluded that there was no evidence from the data evaluated that suggested substantial impacts to fish or benthic macroinvertebrate communities resulting from varied concentrations of chlorides and sulfates. However, EPA's literature review found multiple studies that determined specific ion concentrations and ratios can have effects on the toxicity of TDS to multiple aquatic species (Soucek 2007, Mount et.al. 1997, Goodfellow et.al. 2000). In addition, the ambient chloride concentrations for the streams used in the comparisons did not reach the concentrations of the proposed chloride criterion even at the proposed TDS concentrations. The chloride concentrations proposed are significantly higher than the ambient conditions in the comparison streams presented in the study. Based on this fact, the chloride concentrations seem out of proportion to the TDS and sulfate criteria.

Because a clear demonstration of the effects to aquatic life from the TDS, chloride and sulfate levels discussed has not been provided, this submission does not meet the minimum requirements of a water quality standards submission as described in 40 CFR § 131.6. Therefore, EPA is unable to take action on the site-specific minerals criteria for the unnamed tributary to Nine Mile Creek and Nine Mile Creek. Under 40 CFR § 131.21(c), new and revised standards do not go into effect for CWA purposes until approved by EPA. Therefore, the criteria developed can not be used in a permit or other regulatory program.

References

Goodfellow, et. al. 2000. Major Ion Toxicity in Effluents: A Review with Permitting Recommendations. *Environmental Toxicology and Chemistry* 19(1): 175-182.

Mount, D.R., D.D. Gully, J.R. Hockett, T.D. Garrison, and J.M. Evans. 1997 Statistical Models to Predict the Toxicity of Major Ions to *Ceriodaphnia dubia*, *Daphnia magna*, and *Pimephales promelas* (fathead minnow). *Environmental Toxicology and Chemistry* 16(10): 2009-2019.

Soucek DJ. 2007. Comparison of Hardness and Chloride Regulated Acute Effects of Sodium on Two Freshwater Crustaceans. *Environmental Toxicology and Chemistry* 26(4):73-779.